CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Title: 18 MW Kemphole Mini Hydel Scheme (KMHS), by International Power Corporation Limited, India
Version: 8
Date: 11/03/2011

A.2. Description of the project activity:

Kemphole Mini Hydel Scheme (KMHS) is an 18 MW (3 X 6 MW) Run-of-the-River hydro power project located at Kemphole stream in Hassan district of Karnataka in India. The main activity of the project is generation of electricity using hydro potential available in Kemphole stream and exporting the generated power to Karnataka Power Transmission Corporation Ltd. (KPTCL) as per power purchase agreement between two of them.

KMHS project was completed in two stages; in first stage 2X6 MW units were installed (20th Oct 2003, 20th Nov 2003), in second stage 6 MW was installed (10th Jan 2005). The project activity utilises the water flow and fall available in the Kemphole stream. The project location is situated in dense forests of the Kemphole reserve forest and there is no habitation in the near by area. The project does not involve any displacement of local population and associated rehabilitations. The project uses horizontal Francis turbines for power generation.

The project is based in Netravathi river basin. As this is the first project in the river basin (it is tough terrain), there was no data available for gauging of the power potential. Many technological/structural innovations have been introduced in the project activity like to utilise automatic thrash-rack-cleaning system etc. Further the project activity is in a hilly area and is surrounded by dense forest with no power evacuation facility, for a distance of 29 KMs, a transmission system (with 124 towers) had to be created by the project proponent to evacuate power in the nearby substation.

The project generates electrical energy through sustainable means without causing any negative impact on environment. Use of renewable sources for power generation contributes to mitigation of greenhouse gases emissions. Apart from the power generation project activity shall also contribute to the following:

a. Sustainable development through utilization of renewable hydro resources available in the project region.
b. Contribution to power requirements of Southern Region (SR) grid.

Conserving environment and its natural resources (like coal, petroleum oils etc.) through use of renewable source of energy.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	International Power Corporation Limited (IPCL)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The KMHS is located in Heggadde village of Hassan district, Karnataka. The project site is located at about 26 KM from Sakaleshpura along Hassan-Mangalore highway

A.4.1.1. Host Party(ies):

Host Party: India

A.4.1.2. Region/State/Province etc.:

State: Karnataka

A.4.1.3. City/Town/Community etc:

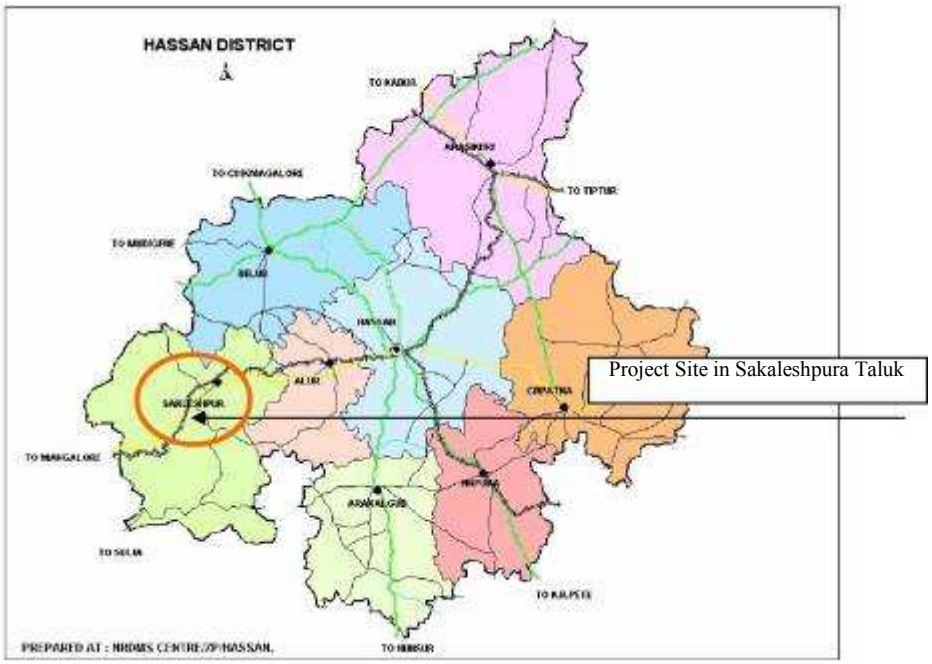
Village: Heggadde
Taluk: Sakaleshpura
District: Hassan
State: Karnataka

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The Gundia River is one of the important tributaries of river Kumarashara, which in turn is a tributary of Netravathi River. Gundia River is formed by streams namely Yettinahole & Kemphole to which streams Kadumane hole and Hongadahalle join in the course.

Geographical coordinates of weir site of KMHS project activity isLatitude -12°50'30"N and Longitude -75°40'30"E and of the power house is Latitude -12°50'17.98 "N and Longitude -75°40'11.88"E

The project is located in the Kemphole stream. Location of project activity is presented in Attachment 1 of this document.



A.4.2. Category(ies) of project activity:

The project is a run-of-river hydro power project and categorized in consolidated baseline methodology **ACM0002/Version12/ EB 52, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"**[1]

Scope: Number 1
Sectoral Scope: Energy Industries – Renewable/ Non renewable source

A.4.3. Technology to be employed by the project activity:

The Project uses well established hydro power generation technology in electricity generation and transmission. A gated weir across Kemphole, downstream of confluence of Kadumanehole with Kemphole is constructed. The river bed level at the gated weir site is 319 m and the full reservoir level of the weir is 340 m. Three horizontal Francis turbines of 6 MW capacity each coupled with horizontal 3 phase, 50 Hz, 500 rpm synchronous generators are used. The gross head available for the project is 68 meter. A 66 KV double circuit transmission line (total 124 towers over 29 KMs) from the switchyard to the 11/66 KV sub-station at Sakaleshpura is used for power evacuation from the project activity**.**

[1] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_71ZC14NVE4V5DHA3TUT3896PFLPVGG

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

The expected emission reductions are calculated based on the net electricity export and combined margin emission factor of the Southern grid 0.86 tCO_2/MWh[2]. Annual estimates of emission reductions and total emission reductions for the chosen renewable crediting period of 7 years are furnished below.

Table A.2: Annual estimation of Certified Emission Reductions (CERs)

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2010-11	44,548
2011-12	44,548
2012-13	44,548
2013-14	44,548
2014-15	44,548
2015-16	44,548
2016-17	44,548
Total estimated reductions (tCO_2 e)	**311836**
Total number of crediting years	**7**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	44,548

A.4.5. Public funding of the project activity:

IPCL is promoted by Public Power International Inc, USA. Equity investment is done by USA based promoters. However this financing is not part of an International Official Development Assistance (ODA) effort. Details of investments are available to DOE for validation.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Title of the approved baseline and monitoring methodology: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

Reference: ACM0002, Version12 (EB 52), Sectoral Scope: 1.
Tool used: "Tool to calculate the emission factor for an electricity system" Version 2 EB – 50, Annex 14

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

According to the approved consolidated methodology ACM0002 version12; "This methodology is applicable to grid-connected renewable power generation project activities that involve electricity capacity additions.

[2] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

The project activity is grid connected hydropower project and satisfies the applicability criteria of the methodology, according to the analysis below:

Table B1. Applicability condition in ACM0002 version12 and position of present project activity

Applicability Conditions in the ACM0002, Version12	**Project activity vis-à-vis applicability conditions**
The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The project activity is installation of a new grid connected run-of-the river hydro power project
In the case of capacity additions, retrofits or replacements: the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	The project is a green-field project and does not involve capacity additions, retrofits or replacements.
In case of hydro power plants: *- The project activity is implemented in an existing reservoir, with no change in the volume of reservoir.* *- The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2.* *- The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.*	This is a run of the river hydro power project which does not involve construction of any reservoir This is a run of the river hydro power project which does not involve construction of any reservoir This is a run of the river hydro power project which does not involve construction of any reservoir.However The power density of the project taking into account the weir place is 450 W/m^2 (please refer Section B.6.1 for details of calculation) which is higher than 4 W/m^2. Hence, the project activity satisfies this applicability criterion.
Methodology is not applicable to the following *Project activities that involve switching from fossil fuels to renewable energy sources at the*	 The project activity is installation of a new grid connected run-of-the river hydro power project

site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;	and does not involve switching from fossil fuel to renewable energy
Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2.	This is a run of the river hydro power project which does not involve construction of any reservoir.
Biomass fired power plants	This is a run of the river hydro power project and not a biomass plant

B.3. Description of the sources and gases included in the project boundary

According to ACM0002 Version12, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.
The project activity utilises the water flow and fall available in the Kemphole stream. The project boundary encompasses Weir, Tail race Canal, penstocks, Surge Tank, Power House where Butterfly Valves, Turbine, Generator and other Excitation Systems are installed and power evacuation system to KPTCL Which is part of Southern Region grid. The power generated from the project would be evacuated through Grid. Further the single line diagram mentioning the project boundary also annexed in Fig-B in the annexure to PDD.

The emission sources included in or excluded from the baseline and project emission scenario are tabulated below:

Table B.2: Gases excluded/included in the baseline scenario and the project activity

Source		Gas	Included	Justification/Explanation
Baseline Emissions	CO_2 emissions from electricity generation in fossil fuel fired power plants displaced due to the project activity.	CO_2	Yes	Main emission source
		CH_4	No	Negligible in fossil fuel fired power generation
		N_2O	No	Negligible in fossil fuel fired power generation
Project Emission	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam.	CO_2	No	Not applicable, as this project does not involve harnessing geothermal energy.
		CH_4	No	
		N_2O	No	
	For geothermal power plants, CO_2 emissions From combustion of	CO_2	No	Not applicable, as this project does not involve harnessing geothermal energy.
		CH_4	No	

	fossil fuels required to operate the geothermal power plant.	N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	Negligible
		CH_4	No	As the power density of the project is 450 W/m^2 (greater than $10W/m^2$) the resulting CH_4 emissions can be ignored for simplicity.
		N_2O	No	No significant emissions

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

According to the applicable methodology, the process of identification of baseline scenario is as follows:

If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

If the project activity is the modification/retrofit of an existing grid-connected renewable power plant/unit, the baseline scenario is the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid ($EG_{baseline}$, in MWh/year) at historical average levels ($EG_{historical}$, in MWh/year), until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production ($EG_{baseline}$) is assumed to equal project electricity production (EG_y , in MWh/year), and no emission reductions are assumed to occur.

As per the methodology ACM0002 version12 the baseline is evaluated prior to the 2nd crediting period using the tool to assess the validity of original /current base line and update the baseline at the renewal of crediting period.- Annexure1,EB46 Annexure 11:

Step-1:

Assessing the continued validity of the baseline:

The "Procedures for the renewal of the crediting period of a registered CDM project activity" approved by the CDM Executive Board require assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline.

The validity of the current baseline is assessed using the following Sub-steps:

Step-1.1
Assess Complaint of the current baseline with relavant mandatary National and /or Sectoral Policies:

In assessing the continued validity of the baseline, it has been observed that there has been no change in the relevant national and/or sectoral regulations between the first and the second crediting periods.

For the project activity, the mandated regulations and approval processed for implementation remains same at the start of the second crediting period. All regulations are in place that enforces the practice or norms or technologies that are used by the project activity. There has been no such new regulation for approval and installation (formulated after the registration of the project activity) and all existing procedures have been examined to determine if it applies to existing plants or not. Since there is no new regulation which applies to existing CDM project activity during the renewal of crediting period hence, the baseline does not require to be reviewed and, since no new regulation is binding as the project is commissioned power plant, the baseline for the project activity does not require to be taken into account during this request for renewal. This project activity has been a Greenfield project and PP is applying for second crediting renewal and is not a modification or retrofit of an existing power generation facility.

Hence step1.1 in accessing the complaiance of current base line in the domain of the country or region with relavant mandatory national or sectoral policy have been checked and would continued to be the same as was the scenario during the first crediting period.

Step 1.2:

There is no change in Project design and equipments and as such the project which was installed in the year 2003 and 2005 remains same. As such due to the renewal of crediting period the project was continued to displace the grid, the possible baseline scenario is established in the first crediting period and continued to be the baseline scenario during the post renewal of crediting period also. It can be enanciated from the above that there has been no impact on the identification of the baseline scenario which was done prior to the registration of the project.

Step 1.3:

This applies, for example, to project activities that i) reduce the release of waste gases (e.g. HFC-23, N2O, CH4) which would have continued to be released in the absence of the project activity; ii) retrofit a plant which would have continued to operate in the same manner in the absence of the project activity; iii) construct a new plant where, in the absence of the project activity, the project participants would not have constructed the plant but where the product (e.g. electricity, cement, aluminium, etc) would have been generated in other existing plants and/or in new plants constructed by third parties elsewhere

The above specific points is not applicable to this project. The remaining life time of the equipment which has been used is 23 years . Project has been operational for 7 years; 30 years was the lifetime of the project as per the DPR approved for the project. Hence lifetime of the project remaining is 23 years. Since this current renewal crediting is for seven years the life it does not excceds the remaining life time of the equipments.

Step 1.4:

Assessment of the validity of the data and parameters :

The emission factors have been updated as per the tool to calculate emission factor version 2 and has been calculated in detail in annexure 3 of the PDD.
With the application of Step 1.1,step1.2 ,step1.3 and step1.4 the baseline of the project has been found to be requiring an updation for the renewal of crediting period. Hence step 2 is applied.

Step 2
Update the current base line baseline and the data and parameters :

Step 2.1

Update the current baseline

Grid selection for combined margin calculation:

The Central Electricity Authority (CEA) publishes CO_2 baseline data for five regional grids of India viz. Northern, Eastern, Southern, Western and North-eastern. This is the most reliable and up-to-date grid emission data available in public domain. For financial year 2007-08 and later, the four out of five grids (except the Southern), operating on same frequency, have been combined to create a new grid NEWNE for CO_2 baseline calculation. KMHS Hydroelectric Project will supply energy to the Southern Region grid, hence Southern Region grid has been chosen for baseline combined margin calculations

Step 2.2:

Update the data and parameters:

As per ACM0002 version12 "*For updating the baseline at the start of the second and third crediting period, new data available will be used to revise the baseline scenario and emissions. Project participants shall assess and incorporate the impact of new regulations on baseline emissions*"

CEA database version 05 is the recent CO_2 database available at the time of PDD submission for renewal crediting period. It is observed that CO_2 emission factor for Southern Region grid as per CEA database version 05 is $0.86tCO_2/MWh$[3] (this is estimated as per tool to calculate emission factor version 2) *whereas during the project registration emission factor was $0.814tCO_2/MWh$. Hence it is evident that baseline scenario is continued to be fossil fuel based power generation and the original baseline is updated with regard to increase in fossil fuel mixture of the grid.

Hence the baseline scenario is established as:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system", version 02(EB 50 Annex 14)

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The KMHS is a Run-of-the-River hydel project which is exporting power to KPTCL. The power generated by the project activity displaces the power that would have otherwise been generated by SR

[3] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm ; Please refer Annex 3 for detail estimation of the grid emission factor.

- Please refer annexure 3 for detailed calculation

grid. SR grid is operating with a mix of hydro, nuclear and fossil fuel power plants.

As per the decision 17/cp.7 Para 43, a project activity is considered additional if anthropogenic emissions of green house gases by sources are reduced below those that would have occurred in the absence of the registered project activity.

In the absence of project activity, there shall be extra burden on the state grid that shall be equal to the amount of electricity being generated by the project. The state grid comprises of a mix of power plants using hydro, nuclear and fossil fuels for power generation. The CO_2 emission factor calculated for the grid in accordance with the provisions of ACM0002/ Version12 is 0.86tCO2/MWh.

In the following steps project activity is demonstrated as additional following the approach described in "Tool for demonstration and assessment of additionality".

Step 0: Preliminary screening based on the starting date of the project activity

The project activity was started on 20th October 2003 (Start of first stage). The Project Proponent has decided to invest in the Project activity, after accounting for the benefits available under Clean Development Mechanism. The project promoter is applying for the second crediting period.

IPCL was aware that the KMHS project is a GHG abatement project, which could avail financial benefits under CDM if the project activity was found additional wherein the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project.

In year 2003, IPCL came to know about KPTCL's proposition to reduce the power tariff rate below the rate proposed in the PPA signed between IPCL and KPTCL from the sale of power from KMHS. IPCL has done a revised project feasibility assessment based on the revised tariff which was discussed by IPCL management in March 2003. Based on the new scenario project was found to be non attractive for investment. A possibility of availing CDM benefits was explored and a detailed feasibility analysis including CDM benefits was done. With the CDM revenue as one of the annual cash inflows, the KMHS project activity was found attractive for investment. The project feasibility based on CDM revenue was recommended to the Board of Directors for approval in the meeting held on 12th March 2003.

The same has been recorded in various official documents, where the proposed project was approved. These documents will be made available to DOE for validating the project activity.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

In sub steps 1a & 1b realistic and credible alternatives available to project developers are identified which provide output comparable to the project activity. Then it has been verified that whether these alternatives are in compliance with all applicable legal & regulatory requirements or not.

Sub-step 1a- Define alternatives to the project activity:

Project activity is a Run-of-the-River hydro project. Two alternatives can be identified to the project activity for this purpose. Either project developers can implement the project without considering it as a CDM project or situation could continue as it is i.e. no implementation of KMHS.

Alternative 1: Implementation of KMHS not undertaken as a CDM project activity

KMHS is using renewable sources of energy for generation of electric power and exporting it to the Karnataka grid. Thus project activity is displacing certain amount of electricity being generated by the state grid using a mix of power plants and there are no CO_2 emissions by the project activity.

The option is not feasible without CDM benefits as in that case Internal Rate of Return (IRR) of the project is not attractive compared to the cost of funding (Weighted Average Cost of Capital-WACC). Also there were many barriers for implementation of the project. This point is well proven with the help of facts & figures in the subsequent section.

Alternative 2: Continuation of Current Situation

If current situation is continued i.e. KMHS is not implemented there would be no displacement of grid power and an equivalent amount of Carbon-dioxide would continue to be emitted to the environment. This alternative thus truly represents the scenario in the absence of project activity and has been considered as baseline.

Sub Step 1b- Enforcement of applicable laws and regulations

Both of the alternatives identified here are in compliance with applicable laws and regulations.

Conclusion:

As per Step 1 of Tool for demonstration and assessment of additionality two alternatives have been identified to the project activity, there alternatives are in compliance with all applicable laws and regulatory requirements. Thus project activity can be termed as "Additional" up to this stage and can be preceded towards Step 2.

Step 2: Investment Analysis

At this step it has been determined whether the project activity is economically or financially viable and attractive without the sale of Certified Emissions Reduction (CER).

Sub Step 2a- Determining appropriate analysis method

As the project activity generates financial benefits by selling electricity generated by the plant to the KPTCL therefore Option I i.e. Simple Cost Analysis couldn't be applied for investment analysis.

Out of the other two alternatives available i.e. Investment Comparison Analysis and Benchmark Analysis project developer has chosen to apply Benchmark Analysis and has taken Weighted Average Cost of Capital (WACC) as benchmark.

Sub Step 2b- Applying the selected analysis method

The project activity entails high capital cost investments. An investment analysis of the project activity was done based on the Internal Rate of Return as the financial indicator. 'Internal Rate of Return' is one of the known financial indicators used by banks, financial institutions and project developers for making investment decisions. The project activity IRR was then compared with WACC[1] for the project activity.

Sub Step 2c- Calculation and comparison of financial indicators at the time of PDD Registration

The financial internal rate of return of the KMHS project activity without CDM revenues is 12.4 % which much lower than the 16% weighted average cost of capital for the project activity as required by the investors.

The Project IRR without CDM revenues was calculated based on the following parameters:

1. Annual export to KPTCL – 51.80 MU
2. Power tariff rate of KPTCL – INR 3/- per unit with an annual escalation rate of 2%.
3. IRR is computed from the year 2005-2014.
4. Annual CER generated – 43,500
5. Exchange rate - 1EURO equivalent to INR 55/-

All financial data would be available to the DOE in the process of Validation.

Sub Step 2d- Sensitivity Analysis

A detailed sensitivity analysis of the project activity was done to test the project feasibility with varying project parameters. The project activity feasibility is dependent on the following parameters.

Annual export to KPTCL – 51.80 MU
OM Expenses
Tariff paid by KPTCL

Sensitivity Table showing impact of variations in key factors on IRR without CDM revenue:

(a) Variation in Annual Export of power-

SN	Parameters	Variation	IRR	% Change	Comments
1	Annual Export to KPTCL	+10%	13.7%	+ 10.48%	The IRR of the project activity is still lower than the WACC benchmark; The probability of a 10% increase in annual export to KPTCL is not very high. It is unlikely that the hydrological conditions that are available in the project activity are able to sustain a 10% increase in the annual power generation.
		-10%	10.6%	- 14.52%	The IRR of the project activity is very low in comparison of WACC benchmark.

(b) Variation in Power Tariff-

SN	Parameters	Variation	IRR	% Change	Comments
2	Power Tariff paid by KPTCL	+10%	12.7%	+ 2.41%	The IRR of the project activity is still lower than the WACC benchmark i.e. 16%;

		-10%	10.6%	- 14.51%	The IRR of the project activity is lower than the WACC benchmark;

(c) Variation in Expenses -

SN	Parameters	Variation	IRR	% Change	Comments
3	OM Expenses	+10%	12.1%	- 2.42%	The IRR of the project activity is lower than the WACC benchmark.

		-10%	12.7%	+ 2.42%	The IRR of the project activity is still lower than the WACC benchmark. However OM expenses are unlikely to be reduced by 10%.

Conclusion:

Following various sub steps in Step 2 it has been well established and demonstrated that project activity is not a financially attractive option even if all key assumptions on the basis of which IRR has been calculated are changed in both directions and is thus additional.

As in Step 2 it has been concluded that proposed project activity is unlikely to be the most financially attractive now various barriers faced by the project have been summarized under step 3.

Calculation of Financial indicator as per actuals for the period (2004-2010) and projections (2011-2017)

Sub Step 2c- Calculation and comparison of financial indicators at the time of PDD Registration

The financial internal rate of return of the KMHS project activity without CDM revenues is 10.38 % which much lower than the 16% weighted average cost of capital for the project activity as required by the investors.

The Project IRR without CDM revenues was calculated based on the following parameters:

Annual export to KPTCL –Annual power export to KPTCL from 2004 to 2010 is based on actual.

Year ending March 31,	2004	2005	2006	2007	2008	2009	2010
NET POWER GENERATION (MUs)	3.32	32.50	52.02	56.20	58.67	49.59	36.50

51.80 MU (2011-2017)

Power tariff rate of KPTCL – INR 3.25/- per unit with an annual escalation rate of INR 1.02/- INR per unit till 2013 and INR 3.40 /- from 2014-17

IRR is computed from the year 2004-2017.
Annual CER generated – 46,620
Exchange rate - 1EURO equivalent to INR 60/-

All financial data would be available to the DOE in the process of Validation.

IRR as per actual from 2004-2010 and projected values 2011-17 is found to be 10.38% which is less IRR projected during PDD registration 12.4%and less than benchmark 16%. Thus it is evident that KMHS project is additional.

Conclusion:
Following various sub steps in Step 2 it has been well established and demonstrated that project activity is not a financially attractive option even if all key assumptions on the basis of which IRR has been calculated are changed in both directions and is thus additional.

As in Step 2 it has been concluded that project activity is unlikely to be the most financially attractive now various barriers faced by the project have been summarized under step 3.

Step 3: Barrier analysis

Technology Barrier –

Although technology used for power generation through hydrological sources is well established and available in India there were many other technological barriers faced by the project. Due to these barriers it was difficult for the project proponent to go ahead with the project.

- Hydrological Risk: The project is based in Netravathi river basin. As this is the first project in the river basin, and also due to tough terrain there was no data available for gauging of the power potential. The project proponent had made substantial efforts to assess the site potential. Due to lack of old authentic data, project faces performance risk.

- Inflow of waste with Water: Because the site is based in dense forest, thrash material (forest waste like wood, etc) flow into water stream severely risking the power generation equipment.

The project proponents have installed an automatic thrash cleaning system to avoid damages to equipments. Many technological/structural innovations have been introduced in the project activity to utilise automatic cleaning system.

Infrastructural Barrier –

Plant is located in hilly forest area in Karnataka. Lack of infrastructural facilities was a major barrier for project implementation.

- Evacuation facility: The project activity is in hilly area and is surrounded by dense forest with no power evacuation facility in the nearby area up to 29 Km. Project proponents had to install 124 tower transmission systems to evacuate power to the nearby sub-station. Due to extremely difficult terrain (Hilly and forest area) installation of towers was not an easy task and many difficulties were faced in executing the project.

- Lack of support infrastructure: There is no support infrastructure like housing, communication, approach roads etc available for the project implementation. Also there is

shortage of skilled manpower in the region. Lack of infrastructure was a major challenge for the project promoters to implement the project activity.

To overcome technological challenges and lack of infrastructure facilities, additional investments and efforts were required however there were no additional returns/ benefits available from these investments/efforts.

Step 4: Common Practice Analysis

Sub Step 4a- Analyze other activities similar to the proposed project activity

The project activity is supplying power to KPTCL. An analysis of total power generated in the state of Karnataka shows that power generated by hydel projects being implemented by Independent Private Parties (IPP) have a very low percentage of share. In April'2003 only 0.7 per cent of total power generation was done by plants in this category.

The project activity is also the first project in the Netravathi river basin. Lack of hydrological data for the river stream has made it difficult for implementation of hydro power projects.

Sub Step 4b- Discuss any similar option that are occurring

No project activities are found being implemented previously those are similar to the project activity. Thus it can be concluded that implementation of hydel projects by IPP is not at all a common practice in the state of Karnataka in India.

Step 5: Impact of CDM Registration

As discussed in the step 2 & step 3 of the additionality analysis done above, the project is financially not attractive to be undertaken and also faced significant barriers for implementation. IPCL could have decided to invest in the project activity considering the impacts of CDM registration only. Primary incentives and benefits which were considered for this purpose are following possible CDM revenue which makes the project financially attractive for investment. Reduction of GHG emissions in the overall system by use of renewable sources of energy for power generation would attract private sector participation in power generation in the region. Successful implementation of project activity will encourage other project developers to accept a low IRR considering CDM benefits.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

The project activity mainly reduces carbon dioxide through displacement of grid electricity generation with fossil fuel based power plants by renewable energy based electricity. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y \qquad \text{(Formulae 11 of ACM 0002/version12)}$$

Where:
ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2/yr)
PE_y = Project emissions in year *y* (t CO_2e/yr)

According to the consolidated methodology ACM0002 version12 baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$ (Formulae 6 of ACM 0002/ version12)

Where: BE_y = Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh) version 2.

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ would be as per (a) greenfield plants as the plant can be treated as a new hydro power plant and (b) Retrofit or replacement of an existing renewable energy power plant & (c) Capacity addition to an existing renewable energy power plant are not the conditions for the project activity. Hence for,

(a) Greenfield renewable energy power plants

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where: $EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

The baseline emission factor ($EF_{grid,CM,y}$) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors calculated according to the version 2 of "*Tool to calculate the emission factor for an electricity system*".

Project activity emissions

According to the chosen baseline methodology ACM0002 Version12, for *hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for project emissions, estimated as follows*.

If the power density (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = \frac{EF_{Res} \cdot TEG_y}{1000}$$

(As per formulae 3 of ACM 0002/version12)

Where,

PE_y = Emission from reservoir expressed as tCO_2e/year

ES_{Res} = The default emission factor for emissions from reservoirs, and the default value (as per EB 23) is 90 Kg CO_2e /MWh.

TEG_y = Total electricity produced by the project activity, including the electrici electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh).

b) If the power density of the project is greater than 10 W/m^2:

$PE_y = 0$. (As per formulae 4 of ACM 0002/version12)

Since the KMHS project activity is a run-of-river hydro project with power density of 450 W/m^2, (greater than the threshold value of 10 W/m^2 as calculated below), hence according to the chosen baseline methodology ACM0002 Version12, project emissions are nil i.e. $PE_y = 0$.

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ (As per formulae 5 of ACM 0002/version12)

Where:

PD = Power density of the project activity, in W/m^2.

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

For the project activity:

$Cap_{PJ} = 18 \times 10^6$ W

$CAP_{BL} = 0$

$A_{PJ} = 4 \times 10^4$ sq m

$PD = (18 \times 10^6 - 0) / (4 \times 10^4 - 0) = 450$ W/m^2

Leakage

According to the applicable methodology, ACM0002 Version11, the main emissions potentially giving rise to leakage in the context of electricity sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project participants do not need to consider these emission sources as leakage in applying this methodology. Project activities using ACM0002 Version12 shall

not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. Thus, the leakage emissions are nil.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	EF_y
Data unit:	t CO2/MWh
Description:	CO_2 emission factor for the regional grid system
Source of data used:	CEA published grid emission factors
Value applied:	0.86 Average of 3 year OM and its 0.25 weighted and recent year BM, and its 0.75 weighted for second crediting period[4]
Measurement procedures (if any):	With a view to obtaining uniformity of approach in the country towards a common objective, Central Electricity Authority (CEA) values have been used, which are authentic and are made available publicly by Govt of India.
Any comment:	The value applied is the arithmetic mean of the Operating Margin (OM, adjusted for imports) and the Build Margin (BM)

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero
Source of data:	Project site
Measurement procedures (if any):	Determine the installed capacity based on recognized standards
Any comment:	In this project the value is zero

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data:	Project site
Measurement procedures (if any):	Measured from topographical surveys, maps, satellite pictures, etc.
Any comment:	In this project the value is zero

B.6.3 Ex-ante calculation of emission reductions:

Estimation of emission reduction is done based on the formula as per ACM000 2 version 12 and the tool to calculate the value of emission factor is based on version 2.

[4] Tool to estimate the grid emission factor version 2 (Please refer Annex 3 for detail estimation)

Baseline emissions:

Baseline emissions calculated as explained in section B.6.1 above are summarised as below.

BE_y = 51800 MWh * 0.86 tCO_2e/MWh

BE_y = 44,548 tCO_{2e}

Project emissions:

No project emissions are applicable.

Leakage:

No leakage emissions are applicable

Emission reductions:

ER_y = BE_y - PE_y

ER_y = 44,548 - 0

ER_y = 44,548 tCO_2e

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions[5] (tCO2e)	Estimation of baseline emissions (tCO2e)	Estimation of leakage (tCO2e)	Estimation of overall emission reductions (tCO2e)
2010-11	0	44,548	0	44,548
2011-12	0	44,548	0	44,548
2012-13	0	44,548	0	44,548
2013-14	0	44,548	0	44,548
2014-15	0	44,548	0	44,548
2015-16	0	44,548	0	44,548
2016-17	0	44,548	0	44,548
Total Reduction	0	**311836**	0	**311836**
Average	0	**44548**		**44548**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG** facility, export y

[5] The project emissions from DG sets will form a part of the emission reduction calculations and will be calculated after the project is operational.

Data unit:	MWh /yr
Description:	Quantity of electricity supplied by the project plant/unit to the grid in year *y*
Source of data to be used:	From the Joint Meter Reading (JMR)
Value of data	51800 MWh (adopted from the first Registered PDD)
Measurement procedures (if any)	The power generated in three generators has been evacuated through Line 1 and Line 2 and both the Lines are having separate Main and Check meter. The electricity supplied to the grid is monitored by main and check meter in Line 1 and Line 2 :
Monitoring frequency	Energy supplied is measured continuously and recorded monthly. . A monthly Joint Meter Reading(JMR) is prepared for Line 1 and Line 2 and the summation of the same has been considered for the purpose of raising of Invoice and the same has been taken for emission reduction calculation
QA/QC procedures to be applied:	The data is accurately measured by high quality and high accuracy meters installed. Every month these readings are recorded by plant personnel and KPTCL , which are archived for cross-checking. These meter readings in Line1 and Line 2 are used to determine the electricity supplied to the grid by the project activity and determine the extent of mitigation of GHG over the monitoring period. The meters are in the custody of KPTCL. Proper maintenance and calibration procedures are followed to ensure accuracy and reliability of the meter.
Any comment:	The data will be archived electronically and will be kept at least for 2 years after the end of the last crediting period.

Data / Parameter:	**$EG_{facility,importy}$**
Data unit:	MWh /yr
Description:	Quantity of electricity imported by the project plant/unit from the grid in year *y*
Source of data to be used:	From the Joint Meter Reading
Value of data	0
Measurement procedures (if any)	The power imported from the Grid through Line 1 and Line 2 and both the Lines are having separate Main and Check meter. The electricity imported from the grid is monitored by the Main meter and the Check meter in Line 1 and Line 2 installed in the switchyard area near the plant. :
Monitoring frequency	Energy imported from grid is measured continuously and recorded monthly. . A monthly Joint Meter Reading(JMR) is prepared for Line 1 and Line 2 and the summation of the same has been considered for the purpose of raising of Invoice and the same has been taken for emission reduction calculation
QA/QC procedures to	The data is accurately measured by high quality and high accuracy meters installed. Every month these readings are recorded by plant personnel and

be applied:	KPTCL , which are archived for cross-checking. These meter readings in Line 1 and Line 2 are used to determine the electricity used from the grid by the project activity and determine the extent of mitigation of GHG over the monitoring period. The meters are in the custody of KPTCL. Proper maintenance and calibration procedures are followed to ensure accuracy and reliability of the meter.
Any comment:	The data will be archived electronically and will be kept at least for 2 years after the end of the last crediting period.

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh /yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data to be used:	From the Invoice raised
Value of data	51800 (adopted from the first registered PDD)
Measurement procedures (if any)	The net electricity supplied to the grid is the difference of power exported to the grid and power imported from the grid in Line 1 and Line 2. A monthly Joint Meter Reading(JMR) is prepared for Line 1 and Line 2 and the summation of the same has been considered for the purpose of raising of Invoice and the same has been taken for emission reduction calculation :
Monitoring frequency	Net energy supplied is measured continuously and recorded monthly. . A monthly Joint Meter Reading (JMR) is prepared and the same has been considered for the purpose of emission reduction calculation
QA/QC procedures to be applied:	The data is accurately measured by high quality and high accuracy meters installed. Every month these readings are recorded by plant personnel and KPTCL , which are archived for cross-checking. These meter readings are used to determine the net electricity supplied to the grid by the project activity and determine the extent of mitigation of GHG over the monitoring period. The meters are in the custody of KPTCL. Proper maintenance and calibration procedures are followed to ensure accuracy and reliability of the meter.
Any comment:	The data will be archived electronically and will be kept at least for 2 years after the end of the last crediting period.

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data:	Project site
Value of data	18000000
Measurement procedures (if any):	Determine the installed capacity based on recognized standards. The project capacity is fixed at the time of installation of the project and the capacity has to be checked every year to ensure that there is no change from the value as mentioned during the registration of the project
Monitoring frequency:	Yearly
QA/QC procedures:	This parameter is a fixed value for a hydro power plant and has to be checked every year to be consistent
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data:	Project site
Value of data	40000
Measurement procedures (if any):	Measured from topographical surveys, maps, satellite pictures, etc. The same has to be checked with the data available during the registration of the project.
Monitoring frequency:	Yearly
QA/QC procedures:	This parameter is a fixed value for a hydro power plant and has to be checked every year to be consistent
Any comment:	-

B.7.2 Description of the monitoring plan:

A CDM project team is constituted with participation from relevant departments. People are trained on CDM concept and monitoring plan. This team will be responsible for data collection and archiving. This team will meet periodically to review CDM project activity check data collected, emissions reduced etc. On a weekly basis, the monitoring reports are checked and discussed by the seniors CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions. On monthly basis, these reports are forwarded at the management level. Detailed monitoring plan attached in Annex-4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completion of the application of the baseline and monitoring methodology:
Date: 05/04/2010
Ganapathy Subramanian
Srividhya Consultancy Services
Flat no. 207, Unnathi Citadel, 353/2, 24th Main,
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Tel (Fax) : +91 80 26490903 Mobile No. : +919880595174 e-mail: srividhyaconser@gmail.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The management of IPCL approved the KMHS project activity in March 2003. However site civil construction started in June 2002. 20st October 2003; the project activity (first unit of 6 MW) has started generating power. KMHS project was completed in two stages; in first stage 2X6 MW units were installed (20th Oct 2003, 20th Nov 2003), in second stage 6 MW was installed (10th Jan 2005).

Project Proponent is applying for renewing second crediting period.

C.1.2. Expected operational lifetime of the project activity:

23 Years [6]

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

20th October 2003

C.2.1.2. Length of the first crediting period:

>>

7 Years

C.2.2. Fixed crediting period:

>>

N/A

C.2.2.1. Starting date:

>>

N/A

C.2.2.2. Length:

>>

N/A

[6] Project has been operational for 7 years; 30 years was the lifetime of the project as per the DPR approved for the project. Hence lifetime of the project remaining is 23 years.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

The environmental assessment studies (two) have been carried out in a corridor of 10 Km. on the either side of Kemphole. The reports fully follow the guidelines of the Ministry of Environment and Forest, Government of India issued time to time. Accordingly the environment impact of the project area is evaluated bringing out the beneficial and ill-effect of the project.

The following are the salient conclusions of Environment Impact Study:

a) Project is a run-of-the-river scheme and submersion is least.
b) No water was extracted from ground during construction phase.
c) No surface water is being sourced during the operational phase and no effluent is being released into the surface water.
d) The impoundment of water behind the weir is negligible and doesn't result in landslides or any effect on earthquakes or any other geotechnical adverse effect.
e) Construction activity had brought normal changes to site topsoil and some components of the land. But these impacts were kept minimized by adopting the best technology and appropriate measures.
f) There is no agricultural activity near surrounding the project site.
g) The proposed project comes within the uninhabited village therefore there was no displacement of population. The progressive development and operation of the project has in no way affected the sparsely distributed village life in the catchment area.
h) Within the radius of 25 Km from the project, there are no ecologically sensitive areas. Hence the implementation of project in no way affected the wild life. Birds, plants and animals common to cultivated and populated areas are found in the area. No rare or endangered species have been reported.
i) During construction excavation, temporary storage of materials caused unsightly conditions and dusty atmosphere. But developers had undergone a good housekeeping and proper handling of solid waste. This had definitely enhanced the visual compatibility of the project.

The project thus does not have any negative effect on the environment on the whole. There are many beneficial effects such as increase in aquatic fauna, improvement in ground water level and increase in the vegetation density etc. which has brought over all enhancement of the environment and improvement in the socio-economic condition and living standards of the people in the area.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

As discussed above environmental impacts of the project can not be categorized as significant as per guidelines issued by regulatory authorities in host party. The project activity is a run-of-the-river type and hence there was no submersion of nearby land. Land being used by the project is minimal considering the magnitude of the project and no adverse affects can be counted on the flora and fauna of the surroundings due to proposed activity.

In general, there are no major adverse effect on the environmental components and ecosystems of the region due construction and operation of the project. EIA studies conducted by the project developers before start of the project activity revealed that the project will generate the much needed electricity with least disturbance to the eco-systems of the surroundings. It has been observed that project has been able in accomplishing this assessment very well.

There were some normal temporary inconvenience during construction phase but developers have been successful in mitigating those through a proper Environment Management Plan as under:

SN	Impact	Mitigation Plan
1	Disposal of excavated material from the power canal and related areas	Surplus excavated material was disposed of so as to merge with the environment to provide areas for forestry. Monsoon season was avoided for the construction particularly for excavation work. Proper Soil erosion Check Dams and Dykes were provided for control of soil erosion.
2	Acquisition of land likely to be submerged	Preliminary designs were made and land likely to be submerged and used for power channel was identified. This land came in the category of marginal land with gravelly and lithic type of soils.
3	Acquisition of land for the footings of transmission tower	Land required and used for transmission towers footing is also minimal. Transmission lines were laid avoiding reserved forest areas. This route is devoid of vegetation and didn't involve cutting of trees and any disturbance to any wild life. The study of the transmission line system indicates that the route length is on exposed rock and little soil cover.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

A meeting with all stakeholders for the project was organised by IPCL. Documentary proofs and minutes of these meetings are maintained and can be presented at the time of validation.

Following stakeholders were consulted:

Village Panchayat
Local population
Various NGOs working in the area

Sarpanch of the Village Panchayat was present in the meeting along with sufficient number of participation from the local population.

Besides project proponents have also received all necessary approvals & clearances from Government bodies like Karnataka Renewable Energy Development Authority (KREDA), Karnataka Pollution Control Board (KPCB) and Environment Department, Government of Karnataka.

E.2. Summary of the comments received:

>>

Project activity doesn't involve any significant negative impact over social structure and environment. Therefore all stakeholders had really shown their pleasure and support to the project activity. Comments received from stakeholders are well documented and can be presented for verification at the time of validation

E.3. Report on how due account was taken of any comments received:

>>

No negative comment was received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	International Power Corporation Limited, India
Street/P.O.Box:	Defense Colony, HAL, 2nd Stage,
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URL:	
Represented by:	
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Salutation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

IPCL is promoted by Public Power International Inc, USA. Equity investment is done by USA based promoters. However this financing is not part of an International Official Development Assistance (ODA) effort. Details of investments are available to DOE for validation.

Annex 3

BASELINE INFORMATION

This project uses grid emission factor calculations officially published by the Central Electricity Authority (CEA) of India, following the approaches and rules defined in Tool to calculate emission factor for an electricity system (Version 02) EB 50, Annex 14. For details and further information on data please see CEA CO_2 data base from the following web link: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm "CDM Carbon Dioxide Baseline Database, Version 5(November 2009)" Details of baseline are presented in Section A.4 of this document.

The baseline emission factor ($EF_{grid,CM,y}$) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors calculated according to the version 2 of "Tool to calculate the emission factor for an electricity system", using following seven steps

STEP 1: Identify the relevant electricity systems.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3: Select a method to determine the operating margin (OM).
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Identify the group of power units to be included in the build margin (BM).
STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity system.

As per the tool:

"*For determining the electricity emission factors, a project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.*

Similarly, a connected electricity system, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used."

Since present projects under consideration lies in the state of Karnataka which lies in Southern Region of India, Southern Region Grid of India, is recognised as the relevant electricity system.

Step 2: Choose whether to include off grid power plants in the project electricity system.

Option I: only grid power plants are included in the calculation.
Option II: both grid power plants and off grid power plants are included in the calculation.

Option I is chosen since the project supplies electricity to the grid alone.

Step 3: Select a method to determine the Operating Margin (OM)

The calculation of the operating margin emission factor (*EFgrid,OM,y*) should be done by one of the following methods:

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM

Project proponent follows option **(a) i.e. Simple OM** for estimation of Operating Margin emission factor.

The Simple OM method can only be used where low-cost/must run resources[7] constitute less than 50% of total grid generation in:

- Average of the five most recent years, or
- Based on long-term averages for hydroelectricity production.

Table B.2: Share of Must-Run (Hydro/Nuclear) (% of Net Generation) [8]					
	2004-2005	**2005-06**	**2006-07**	**2007-08**	**2008-09**
NEWNE	25.4%	18.0%	18.5%	19.0%	17.3%
South	**21.6%**	**27.0%**	**28.3%**	**27.1%**	**22.8%**
India	18.0%	20.1%	20.9%	21.0%	18.6%

The average generation from low cost must run resources constitute only 25.36 % (Average of the values from 2004-2005 to 2008-2009 for South) [11] of the Southern Grid (Table B.2).

Since only **25.36%**[9] of energy generated is low cost must run (much lower than 50%), therefore Simple OM is used to calculate emission factor.

The Simple OM emission factors can be calculated using either of the two following data vintages for years(s) *y*:

[7] Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.- " Tool for calculating emission factor for an electricity system Version 2", EB 50, Annex 14.

[8] Results page from Database for publishing CO2 emissions version 5 and version 4, CEA; downloaded from http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm on 30th November 2009.

[9] Average of the values from 2004-2005 to 2008-2009 for South (Table B.2)

Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculating the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Ex ante option has been chosen in this project activity and emission factor is fixed for the crediting period of 7 years.

Step 4- Calculating Operating Margin (OM) as per the method available for determining Simple OM.
The generation weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.
The Simple OM must be calculated as:

Option A: Based on the net electricity generation and a CO2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The project proponent is using values for calculating OM that are published in the CEA database for calculating CO_2 emissions Version 5. These calculations are based on "*Tool to Calculate the Emission Factor for an Electricity System*", Version 2 EB 50 Annex 14. These correspond with **option A** of the current version of the Tool.

Calculating simple OM using option A

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:
$EF_{grid,OMsimple,y}$ = Simple operating margin CO2 emission factor in year *y* (tCO2/MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m = All power units serving the grid in year *y* except low-cost / must-run power units
y = The relevant year as per the data vintage chosen in Step 3

Calculations were done by the CEA (database version 5, Nov 2009) based on an approach similar to

Option A1 to determine $EF_{EL,m,y}$, in the current 'Tool to calculate emission factor in the electrical system'- Version 2, EB 50 , Annex 14.

Option A1: If for a power unit *m* data on fuel consumption and electricity generation is available, the emission factor (*EFEL,m,y*) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

Where,

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$ = Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m = All power units serving the grid in year *y* except low-cost/must-run power units
i = All fossil fuel types combusted in power unit *m* in year *y*
y = The relevant year as per the data vintage chosen in Step 3

Table B.3: Calculating 3 year generation weighted average of emission factor (Simple OM)

Most recent three years	**2006/07**	**2007/08**	**2008/09**
Operating Margin[10] (OM) in t CO_2 / MWh	1.00	0.99	0.97
Average of 3 years	**0.987**		

The Weighted average of Simple OM is taken as **0.987** tCO_2/ MWh (Table B. 3)

Step 5: Identify the group of power units to be included in the build margin
The sample group of power units used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently; or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Option **'b'** is used for evaluating Build margin.[11]

Step 6: Calculate the build margin emission factor
Build margin is calculated by the formula:

[10] including imports

[11] User guideline for version 5.0, Baseline CO_2 emission database, CEA downloaded from http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm; http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf on December 4th 2009.

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

Build Margin (BM)	**0.82**	tCO_2 / MWh

Build Margin is taken as **0.82 tCO_2/MWh** as per the CEA Database for CO_2 Emissions- Version 5[12], which uses the specified method for calculating BM. **Ex ante option** has been chosen in this project activity and emission factor is fixed for the crediting period of 7 years

Step 7: Calculating combined margin emission factor.

The combined margin emissions factor is calculated as the weighted average of the Operating Margin emission factor (EFgrid, OM, y) and the Build Margin emission factor (EFgrid, BM, y):

$$\mathbf{EF_{grid,\,CM,\,y} = w_{OM} \cdot EF_{grid,\,OM,y} + w_{BM} \cdot EF_{grid,\,BM,y}}$$

As prescribed in the tool" "under step 7, for second and third crediting period
Where the weights w_{OM} and w_{BM}, are 0.25 and 0.75) respectively, and $EF_{grid,\,OM,\,y}$ and $EF_{grid,\,BM,\,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh.

$EF_{grid,\,CM,\,y}$ = 0.25 X 0.987 + 0.75 X 0.82 = 0.86 tCO2e/MWh. For the purpose of conservativeness 0.86tCO_2/MWh is considered for Emission Reduction calculation

As mentioned before, Central Electricity Authority (CEA) has calculated the baseline emission factors for the various regional grids in India according to the formulas specified above. As this is the most authentic information available in the public domain, the baseline emission factor used in the calculation of baseline emissions for the proposed project activity is being referred from the same for transparency and conservativeness.

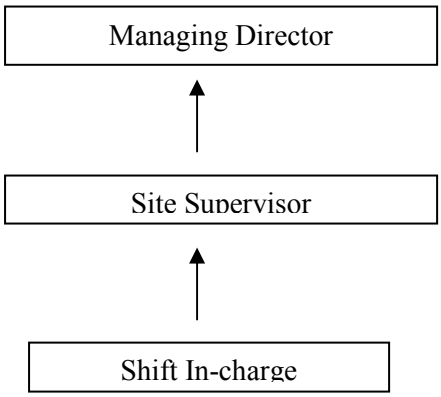
Combined Margin (CM) Simple average of OM and BM	**0.86**	tCO_2 / MWh

[12] Database for CO_2 Emission Database Version 5, published by CEA (Central Electricity Authority), India. Downloaded from http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm; http://www.cea.nic.in/planning/c%20and%20e/database_publishing_ver5.zip on December 4th 2009.

Annex 4

MONITORING INFORMATION

Project Management Plan:
For the purpose of internal audit, PP has formulated Project Management plan. A CDM project team is constituted with participation from relevant departments. People are trained on CDM concept and monitoring plan. This team will be responsible for data collection and archiving. This team will meet periodically to review CDM project activity check data collected, emissions reduced etc. On a weekly basis, the monitoring reports are checked and discussed by the seniors CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions. Once in six months the report of Internal Auditor is forwarded to the management level.



Managing Director: MD has the responsibility to comply with the CDM monitoring plan.
Site Supervisor: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
Shift In-charge: Responsibility of daily report generation

Parameters requiring monitoring

The power generated in three generators has been evacuated through Line 1 and Line 2 and both the Lines are having separate Main and Check meter. Beginning of every Month a Joint Meter Reading (JMR) of Line 1 and Line 2 (which will contain the export and import of both the main meter and check meter separately) will be jointly taken by KPTCL and Project Propenent. Based on this JMR a summation sheet will be attached along with the Invoice where in summation of Net Electricity Exported(difference of export and import as per JMR) is calculated and the value of the same is used while raising the Invoice. The parameter required for the estimation of emission reductions is the net electricity exported to the KPTCL grid, which is taken from the Invoice.

Completeness: For Electricity generation data: The project activity has installed the latest state of art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data collection happens using these control systems. An hourly log of data is also prepared by the shift in-charge. A daily report of aggregation of these data is also prepared. Parameters monitored are power exported to the grid and power imported from the grid.

Reliability: For Electricity generation data automatic control meters regarding power generation and exports are regularly maintained.

The regular plant operating & maintenance procedures also include process of regular meter testing, calibration & maintenance.

A Joint Monitoring Report (JMR) is prepared on the basis of the joint meter reading taken by the plant personnel and KPTCL. Actual power generation data is also metered using power output meter maintained by KPTCL. Every year KPTCL calibrates these meters.

The receipt of sales shall be used to validate the data accuracy.

Frequency- Net energy supplied is measured continuously and recorded monthly A monthly Joint Monitoring Report (JMR) is prepared.

Positioning of Meters and Details of equipment to be monitored

The Metre specifications are as below:-

SN	Line Details	Make	Serial Number of meter	Model Number
1	Line 1 – (Main Meter)	L& T Make	03129384	ER300P
2	Line 1 – (Check meter)	L& T Make	02048046	ER 300P
3	Line 2 – (Main Meter)	L& T Make	03129375	ER300P
4	Line 2 – (Check meter)	L& T Make	03129379	ER 300P

The above Main meter and Check Meter in the switchyard are sealed by KPTCL and are generally calibrated once in a year by KPTCL.

The Main Meter and Check Meter in the switchyard are sealed by KPTCL and are generally **calibrated once in a year by KPTCL with a pre-calibrated meter.** The installed meters are two-way meter and are used for both export and import. The electricity exported to the grid is sum of export measured by Line 1

and Line 2 and same for import of electricity too. The energy generation can also be seen through another set of meters kept in the generator control and metering panel in the control room for unit 1 and Unit 2 separately.

Accuracy: The meters are all tri vector L&T make. The meters have high accuracy level of 0.2%.

Calibration of meters: Calibration of main meters and check meters is done on yearly by KPTCL people.

Dealing with uncertainty: Check meters are provided in line with main meters to take care of any uncertainty related to electricity measurement

Data storage and archiving

All the data items monitored under the monitoring plan will be kept for 2 years after the end of crediting period or till the last issuance of CERs for this project activity whichever occurs later. The monitored data will be presented to an independent verification agency or DOE to whom verification of emission reductions will be assigned.

Training of Operators-

Since there are no major changes in the production technology, no extensive initial training is required. The operator's team is trained on CDM concepts. Operators are also trained on monitoring of data and record keeping (part of usual plant performance data monitoring).

Emergency Preparedness Plan:

Plant has a documented Emergency Preparedness plan. This plan covers operating procedures, Do's and Don't' during emergency.

Monitoring of sustainable development indicator

The project activity contributes to sustainable development of the region. GHG reduction, power generation and employment generation are the main benefits arising from the project implementation. GHG reduction and power generation are monitored regularly as explained in the above monitoring plan. The project activity also keeps a record of number of people employed directly in the project activity.

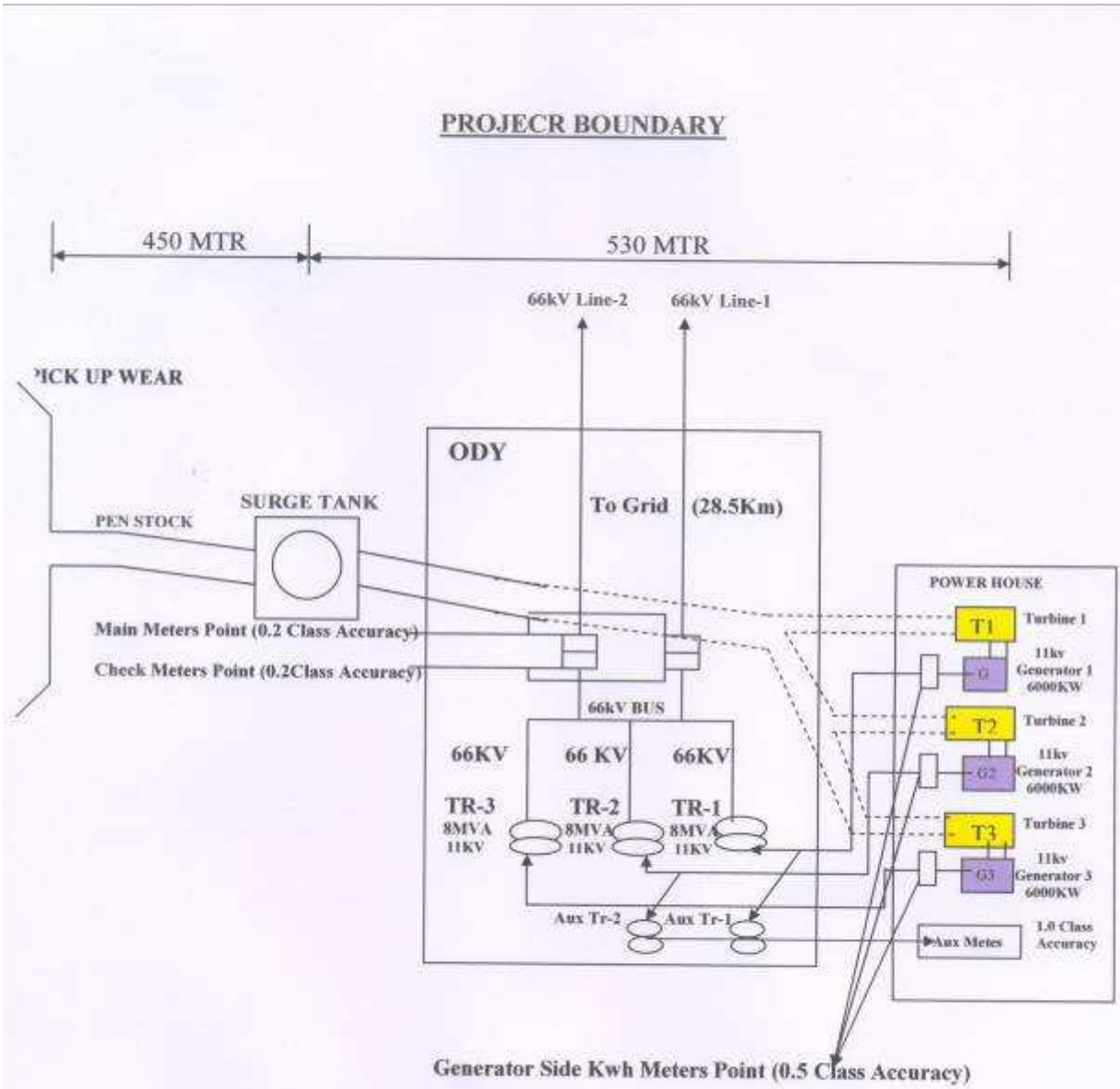
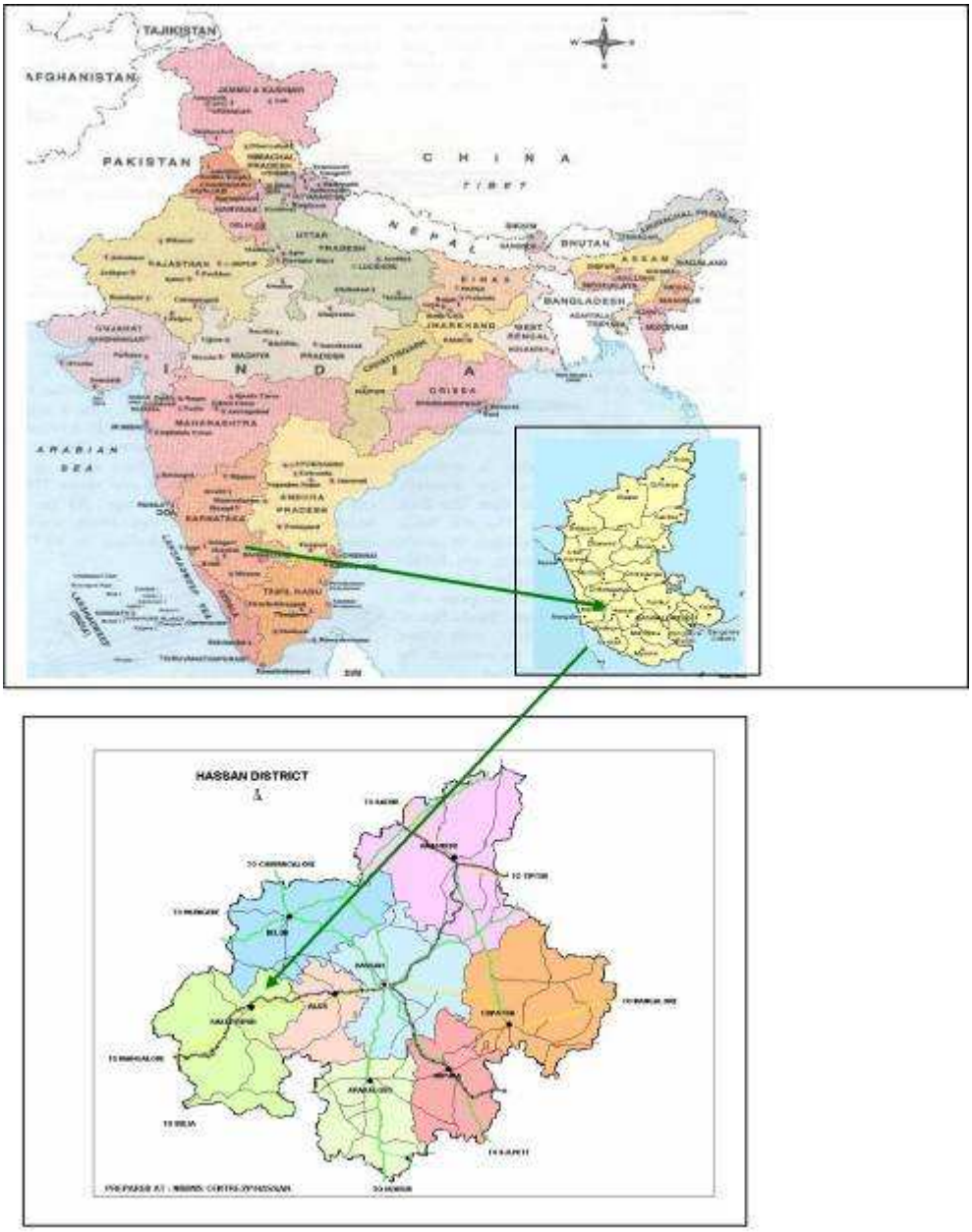


Fig B1: Line diagram of KMHS Project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